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ALGOMA ORE DIVISION - DENSIMETRIC CURVES

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ALGOMA ORE DIVISION - DENSIMETRIC CURVES

by

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ABSTRACT

At the request of Algoma Ore Division, heavy liquid separations were done on three different sized fractions of their plant feed. The data from these heavy liquid separations were used to draw densimetric curves of the three separate size fractions and the three fractions combined into total plant feed.

The objective of these tests was to optimize the % silica rejection of their dense media separators.

All data, and calculations in arriving at the data, were requested by Algoma Ore Division in order that they could use it as they chose in collaboration with Wemco in the optmization process.

No attempt was made (by the author) to interpret the data as other pertinent mill information was not available (to him).

Introduction

A sample of plant feed from Algoma Ore Division, Wawa, Ontario, was received from Mr. D. Carruthers, Plant Metallurgist.

It was requested by Mr. Carruthers that CANMET's, Ore Dressing Section do densimetric curves on three size fractions of the feed, namely; +12,400 µm (+1/2"), 12,400 µm x 595 µm (1/2" x 28M) and 595 µm x 149 µm (28M x 100M).

The objective of these tests was to find the optimum conditions that would increase the efficiency of the Dense Media Separator i.e. a higher silica rejection. The feed processed is a siderite ore ($FeCO_3$) along with its guange minerals; namely silicates. The dense media presently being used by Algoma is ferrosilicon and magnetite.

Sample Preparation

The sample as-received was first weighed to obtain total weight of sample and then run over a Symons screen to separate the three desired size fractions. The total weight, weight of each size fraction, and mass % are shown in Table 1.

Table 1. Original sample

Size	Mass (kg)	Mass %
+12,400 µm	71.44	54.08
12,400 µm x 595 µm	55.75	42.20
595 µm x 149 µm	4.31	3.26
-149 µm	0.61	0.46
Total	132.11	100.00

Since the quantity of -149 µm material was so small in comparison with the total sample, and it is not used in the calculations, it has been disregarded and a new mass distribution calculated (Table 2).

Table 2. New mass distribution

Size	Mass (kg)	Mass %
+12,400 µm	71.44	54.33
12,400 µm x 595 µm	55.75	42.39
595 µm x 149 µm	4.31	3.28
Total	131.50	100.00

These three size fractions were then separately fed to a carousel "Pro-Splitter" to obtain manageable, yet representative samples, for the heavy liquid separations. The samples were then thoroughly washed with clear water and oven dried overnight. The sample weights were then recorded as follows (Table 3).

Table 3. Weights of sample processed

Size	Weight (g)
+12,400 µm	10653.2
12,400 µm x 595 µm	5106.2
595 µm x 149 µm	2130.8

Heavy Liquids

The specific gravities of the feed could range from 3.96 (pure siderite) to 2.65 (pure silica). Since the heaviest liquid available, that can be safely handled in a fume hood is methylene iodide (iodoform), with a specific gravity of 3.30, this was used as the starting point. It was felt that at least 4 points would be required to give a representative densimetric curve, and as a result the following liquids were used for the separations.

Liquid	Specific Gravity
1) Methylene iodide	3.30
2) Methylene iodide + carbon tetrachloride	3.09
3) Acetylene tetrabromide	2.96
4) Acetylene tetrabromide + carbon tetrachloride	2.78

Method Used

Due to the coarseness of the first two size fractions, the separations could not be done in a conventional separatory funnel. As an alternative, a 1000 mL beaker was used with the float portions being spooned off. Middling particles were split evenly between the sink and float. The finest sample, 595 µm x 149 µm (28M x 100M), was treated in a 1000 mL separatory funnel in which the stop-cock bore had been increased in diameter.

Each of the three samples were then subjected to heavy liquid separations beginning at specific gravity 3.30. All sink and float products were thoroughly washed, dried, and weighed. Portions of each were set aside for assay by both CANMET and Algoma before proceeding with separations at the next lower specific gravity. This procedure was repeated for all four specific gravities, the float from the higher specific gravity becoming the feed for the next lower. The weights are recorded in Table 4.

Table 4. Sink-float fractions of processed sample

Size Fraction (µm)	Specific Gravity	Weight Float (g)	Weight Sink (g)	Mass % Float	Mass % Sink
+12,400	3.30	1435.8	9217.4	13.5	86.5
	3.09	1002.0	242.0	80.5	19.5
	2.96	672.6	67.2	90.9	9.1
	2.78	270.0	291.8	48.1	51.9
12,400 x 595	3.30	655.2	4451.0	12.8	87.2
	3.09	468.3	99.0	82.5	17.5
	2.96	277.5	85.6	76.4	23.6
	2.78	105.7	100.1	51.4	48.6
595 x 149	3.30	470.5	1660.3	22.1	77.9
	3.09	299.6	77.8	79.4	20.6
	2.96	172.9	56.3	75.4	24.6
	2.78	74.0	40.0	64.9	35.1

Since portions of the sinks and floats were removed for assay, the % mass must be recalculated to show the actual amounts of sink and float on a 100% basis. These calculations are shown in Table 5. Since the float product from specific gravity 3.30 is re-treated at the next lowest specific gravity, and this float product re-treated again etc. until specific gravity 2.78 is reached, the floats are recalculated and substracted from 100.00 to

determine the new mass % sink. The sink product at specific gravity 3.30 remains constant. This means that the constant sink products for each size fraction i.e. 86.5%, 87.2% and 77.9% (from Table 4) plus the recalculated mass % floats, must add to 100% of the sample. This may be seen in Table 5. Table 5 also shows the assays and units calculated for sinks and recalculated floats.

Table 5. Recalculated mass % sinks and floats. Mass % underlined

Size	Specific Gravity	Mass % - Calculated from test weights	SiO_2 Assay	Units
12,400 µm	3.30	86.5	6.32	546.68
	3.09	13.5 x .195 = 2.63 + 86.5 = 89.13 100 - 89.13 = 10.87	28.90	76.01
	2.96	10.87 x .091 = 0.99 + 89.13 = 90.12 100 - 90.12 = 9.88	43.38	42.95
	2.78	9.88 x .519 = 5.13 + 90.12 = 95.25	52.46	269.12
	Float	100 - 95.25 = 4.75	66.04	313.69
Total		100.00	12.48	1248.45
12,400 µm x 595 µm	3.30	87.2	5.96	519.71
	3.09	12.8 x .175 = 2.24 + 87.2 = 89.44 100 - 89.44 = 10.56	27.28	61.11
	2.96	10.56 x .236 = 2.49 + 89.44 = 91.93 100 - 91.93 = 8.07	38.02	94.67
	2.78	8.07 x .486 = 3.92 + 91.93 = 95.85	51.36	201.33
	Float	100 - 95.85 = 4.15	73.54	305.19
Total		100.00	11.82	1182.01
595 µm x 149 µm	3.30	77.9	4.72	367.69
	3.09	22.1 x .206 = 4.55 + 77.9 = 82.45 100 - 82.45 = 17.55	15.28	69.52
	2.96	17.55 x .246 = 4.32 + 82.45 = 86.77 100 - 86.77 = 13.23	21.22	91.67
	2.78	13.23 x .351 = 4.64 + 86.77 = 91.41	48.22	223.74
	Float	100 - 91.41 = 8.59	84.38	724.82
Total		100.00	14.77	1477.44

Calculated Head for Entire Sample

From the units in Table 5, the individual heads for each size fraction are determined. These heads multiplied by the mass % of the individual size fractions within the entire sample (Table 2) and then added together give the calculated head for the entire sample i.e.:

$$(12.48 \times .5433) + (11.82 \times .4239) + (14.77 \times .0328) = 12.27\%$$

The results from Table 5 are used to calculate Tables 6 and 7. For each of the three size fractions, the % distributions are calculated (Table 6). From Table 6 the cumulative sinks and float can then be calculated (Table 7). Derivations of Tables 6 and 7 may be found in Appendix A.

Table 6. Individual fractions

Specific Gravity	+12,400 µm			12,400 µm x 595 µm			595 µm x 149 µm		
	Mass %	Assay % SiO_2	Dist'n %	Mass %	Assay % SiO_2	Dist'n %	Mass %	Assay % SiO_2	Dist'n %
Sink 3.30	86.50	6.32	43.80	87.20	5.96	44.00	77.90	4.72	24.90
3.30-3.09	2.63	28.90	6.10	2.24	27.28	5.20	4.55	15.28	4.70
3.09-2.96	0.99	43.38	3.40	2.49	38.02	8.00	4.32	21.22	6.20
2.96-2.78	5.13	52.46	21.60	3.92	51.36	17.00	4.64	48.22	15.10
2.78 float	4.75	66.04	25.10	4.15	73.54	25.80	8.59	84.38	49.10
Total	100.00	12.48	100.00	100.00	11.82	100.00	100.00	14.77	100.00

Table 7. Cumulative sinks and floats

Specific Gravity		+12,400 µm			12,400 µm x 595 µm			595 µm x 149 µm		
		Mass %	Assay % SiO_2	Dist'n %	Mass %	Assay % SiO_2	Dist'n %	Mass %	Assay % SiO_2	Dist'n %
Sink	3.30	86.50	6.32	43.8	87.20	5.96	44.0	77.90	4.72	24.9
	3.09	89.13	6.99	49.9	89.44	6.49	49.2	82.45	5.30	29.6
	2.96	90.12	7.39	53.3	91.93	7.35	57.2	86.77	6.10	35.8
	2.78	95.25	9.81	74.9	95.85	9.15	74.2	91.41	8.23	50.9
Float	2.78	4.75	66.04	25.1	4.15	73.54	25.8	8.59	84.38	49.1
	2.96	9.88	58.99	46.7	8.07	62.77	42.8	13.23	71.70	64.2
	3.09	10.87	57.57	50.1	10.56	56.93	50.8	17.55	59.27	70.4
	3.30	13.50	51.98	56.2	12.80	51.74	56.0	22.10	50.22	75.1

Having derived this data on the 3 individual size fractions, the data were then combined to make Tables 8, 9 and 10. These tables transform the results based on the heavy liquid separations of the individual size fractions, as recorded in Table 3, to the results one would get if the total sample, as recorded in Table 2 had been subjected to heavy liquid separations.

Table 8 shows the new mass % for the individual size fractions within the entire sample. These are calculated by multiplying the mass % in Table 6 by the actual mass % in the entire sample as shown in Table 2. Table 9 shows the new mass%, calculated assays and distributions for the entire sample by combining those found for the individual portions as shown in Table 8. Table 10 is calculated in the same manner as Table 7, but shows the cumulative floats and sinks for the entire or total sample rather than for the three individual fractions within the total sample. These three tables then reflect the calculated values for the three individual samples within the total sample and also the values for the entire sample i.e. 131.50 kg as requested by Algoma. Derivations of these tables may be seen in Appendix B.

Table 8. Total sample basis

Specific Gravity	+12,400 µm			12,400 µm x 595 µm			595 µm x 149 µm		
	Mass %	Assay % SiO_2	Dist'n %	Mass %	Assay % SiO_2	Dist'n %	Mass %	Assay % SiO_2	Dist'n %
Sink 3.30	46.99	6.32	43.8	36.96	5.96	44.0	2.56	4.72	25.1
3.30-3.09	1.43	28.90	6.1	0.95	27.28	5.2	0.15	15.28	4.7
3.09-2.96	0.54	43.38	3.4	1.06	38.02	8.0	0.14	21.22	6.2
2.96-2.78	2.79	52.46	21.6	1.66	51.36	17.0	0.15	48.22	15.0
2.78 float	2.58	66.04	25.1	1.76	73.54	25.8	0.28	84.38	49.0
Total	54.33	12.49	100.0	42.39	11.82	100.0	3.28	14.70	100.0

Table 9. Individual fraction - total sample

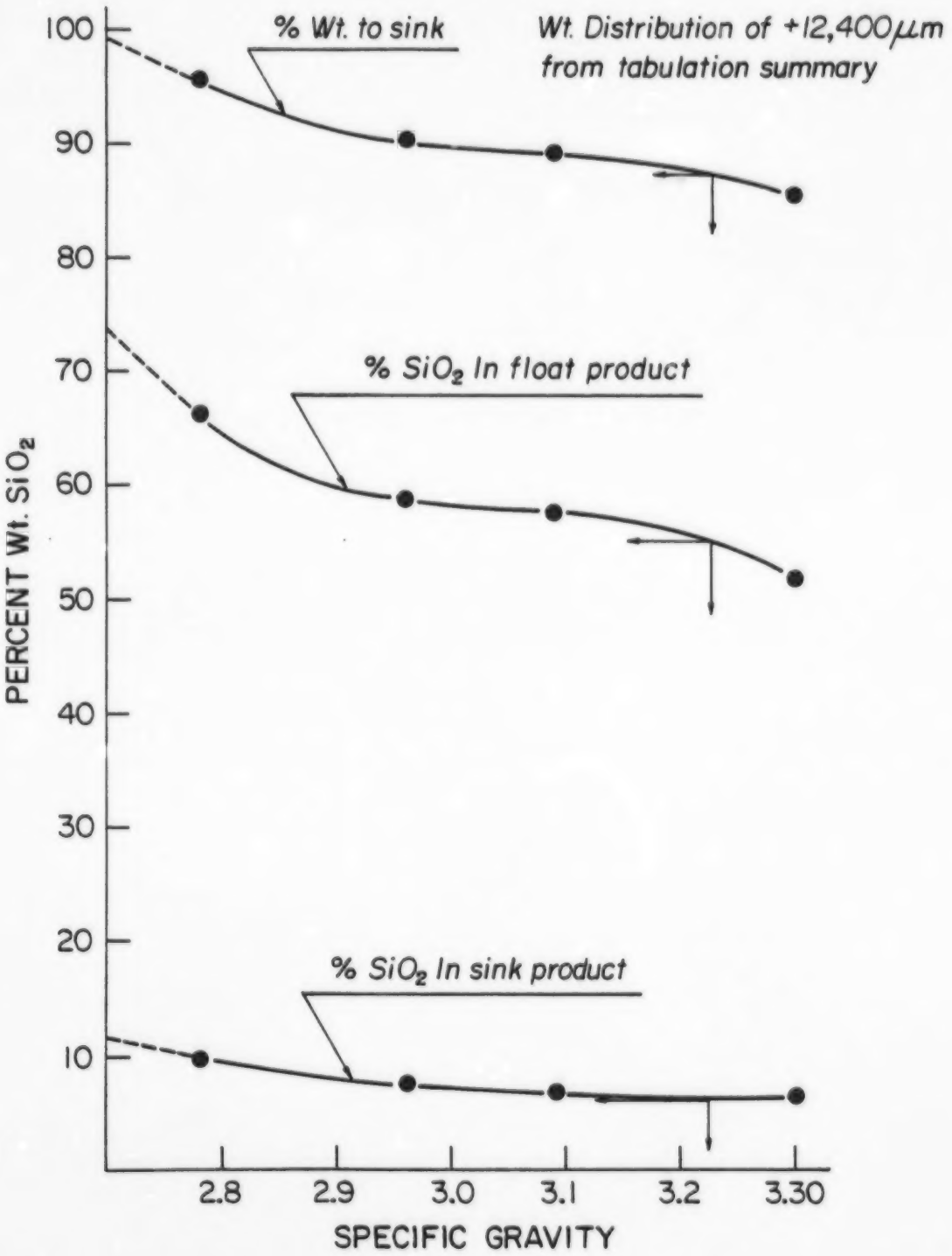
Specific Gravity	+12,400 µm x 149 µm			
	Mass %	Assay % SiO_2	Units	Dist'n %
Sink 3.30	86.51	6.12	529.44	42.7
3.30-3.09	2.53	27.49	69.55	5.4
3.09-2.96	1.74	38.33	66.69	5.3
2.96-2.78	4.60	51.92	238.83	19.9
2.78 float	4.62	70.01	325.45	26.7
Total	100.00	12.28	1227.96	100.0

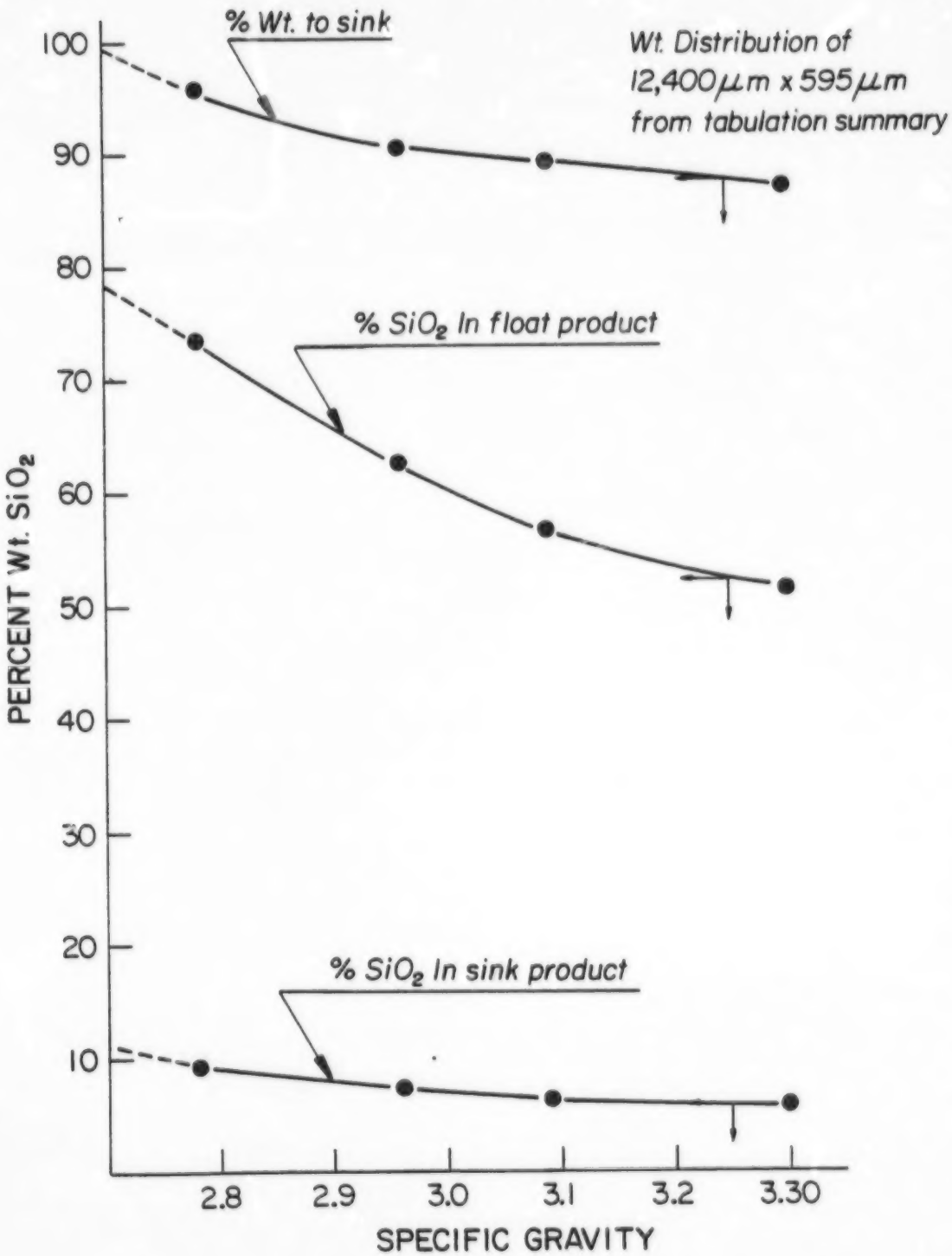
Table 10. Cumulative sinks and floats - total sample

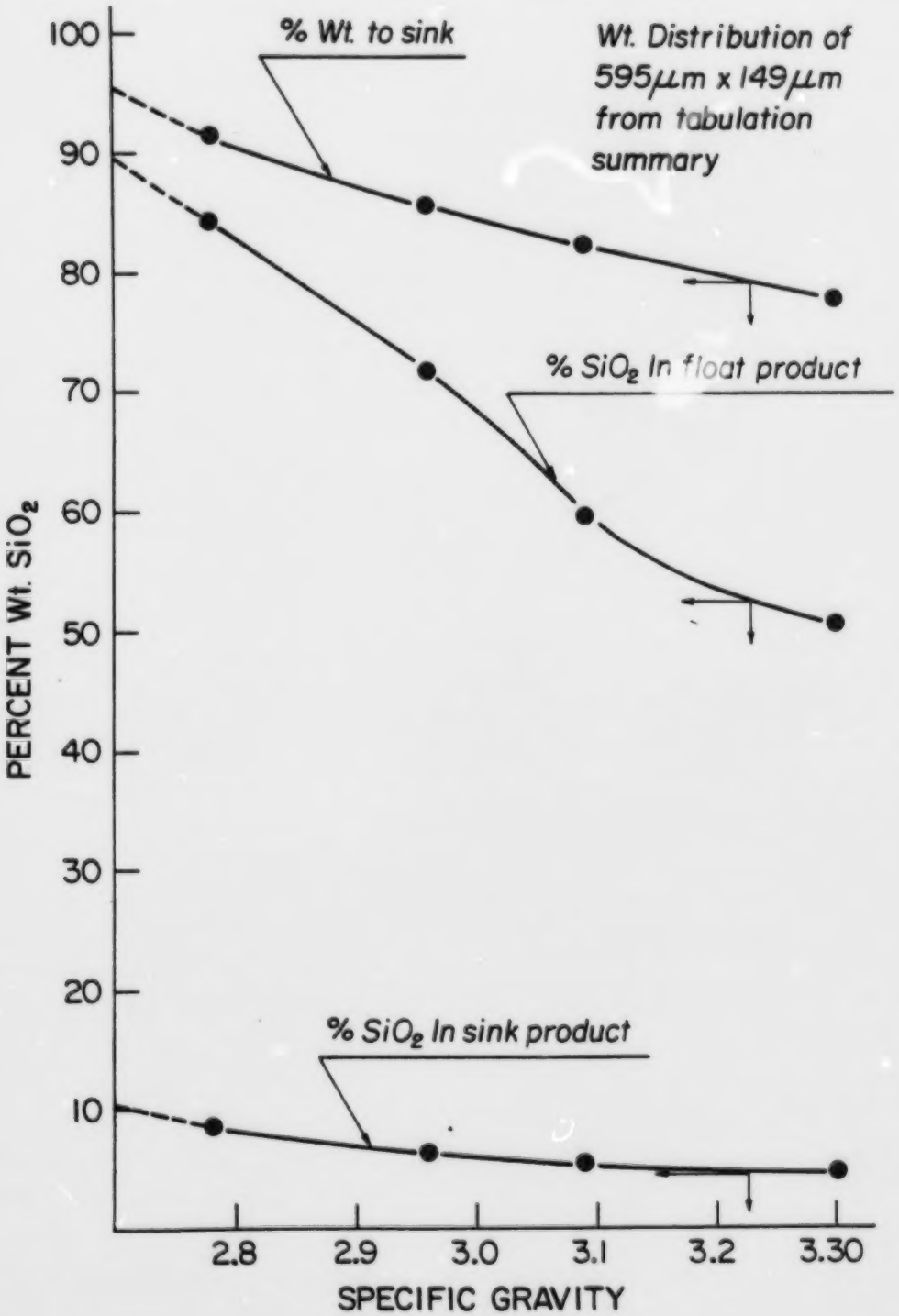
Specific Gravity		+12,400 µm x 149 µm			
		Mass %	Assay % SiO_2	Units	Dist'n %
Sink	3.30	86.51	6.12	526.93	42.7
	3.09	89.04	6.73	595.61	48.1
	2.96	90.78	7.33	661.17	53.4
	2.78	95.38	9.48	899.65	73.3
Float	2.78	4.62	70.01	323.45	26.7
	2.96	9.22	60.99	562.33	46.6
	3.09	10.96	57.39	628.99	51.9
	3.30	13.49	51.78	698.52	57.3

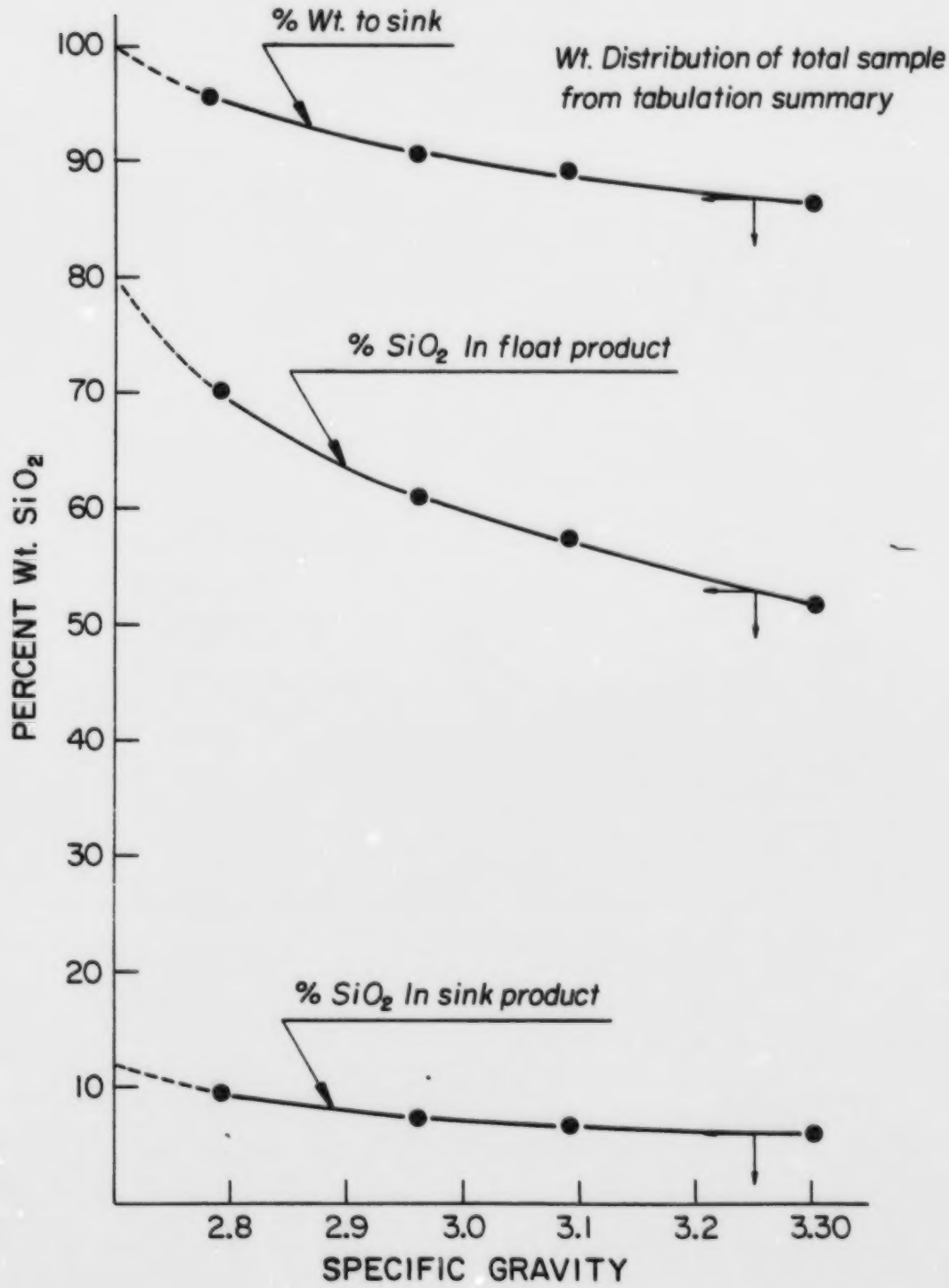
Finally the figures derived for the cumulative floats and sinks on individual size fractions (Table 7), and for the entire sample (Table 10) were used to produce the following graphs.

These graphs show, for each individual size fraction, and on a total sample basis, the curves representing the % weight to sink, the % SiO_2 in the float and the % SiO_2 in the sink.


% Wt. to sink
Wt. Distribution of +12,400μm
from tabulation summary
% SiO_2 In float product
% SiO_2 In sink product
PERCENT Wt. SiO_2
100
90
80
70
60
50
40
30
20
10
2.8
2.9
3.0
3.1
3.2
3.30
SPECIFIC GRAVITY


% Wt. to sink
Wt. Distribution of
12,400μm x 595μm
from tabulation summary
% SiO_2 In float product
% SiO_2 In sink product
PERCENT Wt. SiO_2
100
90
80
70
60
50
40
30
20
10
2.8
2.9
3.0
3.1
3.2
3.30
SPECIFIC GRAVITY


% Wt. to sink
Wt. Distribution of 595μm x 149μm from tabulation summary
% SiO_2 In float product
% SiO_2 In sink product
PERCENT Wt. SiO_2
100
90
80
70
60
50
40
30
20
10
2.8
2.9
3.0
3.1
3.2
3.30
SPECIFIC GRAVITY


% Wt. to sink
Wt. Distribution of total sample from tabulation summary
% SiO_2 In float product
% SiO_2 In sink product
PERCENT Wt. SiO_2
100
90
80
70
60
50
40
30
20
10
2.8
2.9
3.0
3.1
3.2
3.30
SPECIFIC GRAVITY

Discussion

I will not attempt to make any interpretations from the data or the resultant graphs of the densimetric curves. These interpretations will be made by the Algoma Ore Division in conjunction with Wemco.

Suffice it to say that the curves may be used to ascertain the optimum specific gravities to determine the maximum silica rejection at different "cut" points, dependant upon how much % weignt of the sample is going to sink, and thereby determine the minimum % SiO_2 in the float and sink to give the optimum silica rejection. This could prompt them to change the density of their heavy media or from studying the densimetric curves at specific size fractions, it may prove beneficial to go to a courser or finer grind in order to get optimum performance from their separators.

I leave these interpretations to Algoma and Wemco, as they are in possession of other pertinent mill data that would have a bearing on these decisions.

Conclusions

Various types of densimetric curves may be plotted from generated data. I have chosen to present my data in its present form because I have seen curves of a similar nature plotted by Wemco. Because of these various methods of presenting the data, and at the request of Algoma Ore Division and Wemco, I have included all of the data generated and shown in detail the calculations used to develop the tables and graphs presented in this report. Should Algoma or Wemco choose another means of using the data, they should readily be able to do so, as nothing has been excluded. I hope this report will be of use in the optimization of the Dense Media Separators and prove to be helpful in reducing the cost of operation, by a higher silica rejection at this stage in their operation.

A copy of all the assays done by both CANMET and Algoma Ore Division makes up the final Appendix C.

Acknowledgements

The author wishes to acknowledge the time, discussions and expertise of G. Mathieu, Mineral Processing Laboratories, Ore Dressing Section, who always made himself available to explain any questions that arose during the laboratory work and the writing of this report.

Appendix A

Individual Samples Calculations

Size (μm)	Specific Gravity	Mass %	Assay % SiO_2	Units	Dist'n % SiO_2
+12,400	Sink 3.30	86.5	6.32	546.68	43.8
	3.30-3.09	2.63	28.90	76.01	6.1
	3.09-2.96	0.99	43.38	42.95	3.4
	2.96-2.78	5.13	52.46	269.12	21.6
	2.78 Float	4.75	66.04	313.69	25.1
Total		100.00	12.48	1248.45	100.0
12,400 x 595	Sink 3.30	87.2	5.96	519.71	44.0
	3.30-3.09	2.24	27.28	61.11	5.2
	3.09-2.96	2.49	38.02	94.67	8.0
	2.96-2.78	3.92	51.36	201.33	17.0
	2.78 Float	4.15	73.54	305.19	25.8
Total		100.00	11.82	1182.01	100.0
595 x 149	Sink 3.30	77.9	4.72	367.69	24.9
	3.30-3.09	4.55	15.28	69.52	4.7
	3.09-2.96	4.32	21.22	91.67	6.2
	2.96-2.78	4.64	48.22	223.74	15.1
	2.78 Float	8.59	84.38	724.82	49.1
Total		100.00	14.77	1477.42	100.0

Cumulative Sample Calculations

Cumulative mass % and distribution % are calculated simply by adding the data from Table 6.

Eg. +12,400 µm fraction

Cumulative mass %

Sink - 86.5 + 2.63 = 89.13 + 0.99 = 90.12 + 5.13 = 95.25 and

Float - 4.75 + 5.13 = 9.88 + 0.99 = 10.87 + 2.63 = 13.50

Cumulative Dist'n %

Sink - 43.8 + 6.1 = 49.9 + 3.4 = 53.3 + 21.6 = 74.9 and

Float - 25.1 + 21.6 = 46.7 + 3.4 = 50.1 + 6.1 = 56.2

Cumulative Assays

As in the above two calculations the first assay remains constant i.e. 6.32%. The remainder are calculated as follows using data from Table 6 and 7.

Sink 3.09 - (86.5 x 6.32) + (2.63 x 28.90)/89.13 = 622.69/89.13 = 6.99%

Sink 2.96 - 622.69 + (0.99 x 43.38)/90.12 = 665.64/90.12 = 7.39%

Sink 2.78 - 665.64 + (5.13 x 52.46)/95.25 = 934.76/95.25 = 9.81%

Float 2.78 - = 66.04%

Float 2.96 - (4.75 x 66.04) + (5.13 x 52.46)/9.88 = 582.81/9.88 = 58.99%

Float 3.09 - 582.81 + (0.99 x 43.38)/10.87 = 625.76/10.87 = 57.57%

Float 3.30 - 625.76 + (2.63 x 28.90)/13.50 = 701.77/13.50 = 51.98%

In order to prove the validity of Table 8, all cumulative floats and sinks should equal the head samples. These calculations are shown as follows:

Size Fraction (µm)	Specific Gravity	Calculations from Table 7	Head from Table 6 %
+12,400	2.78	(9.81 x 95.25) + (66.04 x 4.75)/100 = 12.48	12.48
	2.96	(7.39 x 90.12) + (58.99 x 9.88)/100 = 12.48	
	3.09	(6.99 x 89.13) + (57.57 x 10.87)/100 = 12.48	
	3.30	(6.32 x 86.5) + (51.98 x 13.50)/100 = 12.48	
+12,400 x 595	2.78	(9.15 x 95.85) + (73.54 x 4.15)/100 = 11.82	11.82
	2.96	(7.35 x 91.93) + (62.77 x 8.07)/100 = 11.82	
	3.09	(6.49 x 89.44) + (56.93 x 10.56)/100 = 11.82	
	3.30	(5.96 x 87.2) + (51.74 x 12.80)/100 = 11.82	
595 x 149	2.78	(8.23 x 81.41) + (84.38 x 8.59)/100 = 14.77	14.77
	2.96	(6.10 x 86.77) + (71.70 x 13.23)/100 = 14.77	
	3.09	(5.30 x 82.45) + (59.27 x 17.55)/100 = 14.77	
	3.30	(4.72 x 77.9) + (50.22 x 22.10)/100 = 14.77	

Appendix B

Total Sample Calculations

Size (µm)	Specific Gravity	Mass %	Assay % SiO_2	Units	Dist'n % SiO_2
+12,400	Sink 3.30	46.99	6.32	296.98	43.8
	3.30-3.09	1.43	28.90	41.33	6.1
	3.09-2.96	0.54	43.38	23.43	3.4
	2.96-2.78	2.79	52.46	146.36	21.6
	2.78 Float	2.58	66.04	170.38	25.1
Total		54.33	12.49	678.48 / 54.33	100.0
12,400 x 595	Sink 3.30	36.96	5.96	220.28	44.0
	3.30-3.09	0.95	27.28	25.92	5.2
	3.09-2.96	1.06	38.02	40.30	8.0
	2.96-2.78	1.66	51.36	85.26	17.0
	2.78 Float	1.76	73.54	129.43	25.8
Total		42.39	11.82	501.19 / 42.39	100.0
595 x 149	Sink 3.30	2.56	4.72	12.08	25.1
	3.30-3.09	0.15	15.28	2.29	4.7
	3.09-2.96	0.14	21.22	2.97	6.2
	2.96-2.78	0.15	48.22	7.23	15.0
	2.78 Float	0.28	84.38	23.63	49.0
Total		3.28	14.70	48.20 / 3.28	100.0

Note: The units column must be divided by the mass % of each individual sample to back calculate the true head assays.

Individual Fraction Calculation for Total Sample

Total mass % is calculated simply by adding the mass % data for each specific gravity in Table 8.

Eg. Sink 3.30

46.99 + 36.96 + 2.56 = 86.51 as shown in Table 9.

Calculated Assays

Sink 3.30 - $\frac{(6.32 \times 46.99) + (5.96 \times 36.96) + (4.72 \times 2.56)}{46.99 + 36.96 + 2.56} = 6.12\%$

3.30-3.09 - $\frac{(28.90 \times 1.43) + (27.28 \times 0.95) + (15.28 \times 0.15)}{1.43 + 0.95 + 0.15} = 27.49\%$

3.09-2.96 - $\frac{(43.38 \times 0.54) + (38.02 \times 1.06) + (21.22 \times 0.14)}{0.54 + 1.06 + 0.14} = 38.33\%$

2.96-2.78 - $\frac{(52.46 \times 2.79) + (51.36 \times 1.66) + (48.22 \times 0.15)}{2.79 + 1.66 + 0.15} = 51.92\%$

2.78 Float - $\frac{(66.04 \times 2.58) + (73.54 \times 1.76) + (84.38 \times 0.28)}{2.58 + 1.76 + 0.28} = 70.01\%$

Note: These new calculated SiO_2 assays are used in Table 9 along with the new total mass% to calculate the new distributions.

Cumulative Sample Calculations - Total Sample

Cumulative mass % and dist'n % are calculated simply by adding the data from Table 9.

Eg. 12,400 µm x 149 µm - Total Sample

Cumulative mass %

Sink - 86.51 + 2.53 = 89.04 + 1.74 = 90.78 + 4.60 = 95.38 and

Float - 4.62 + 4.60 = 9.22 + 1.74 = 10.96 + 2.53 = 13.49

Cumulative Distribution % - Total Sample

Sink - 42.7 + 5.4 = 48.1 + 5.3 = 53.4 + 19.9 = 73.3 and

Float - 26.7 + 19.9 = 46.6 + 5.3 = 51.9 + 5.4 = 57.3

Cumulative Assays - Total Sample

As in the above two calculations the first assay remains constant i.e. 6.12. The remainder are calculated as follows using data from Tables 9 and 10.

Sink 3.09 - (86.51 x 6.12) + (2.53 x 27.49)/89.04 = 598.99/89.04 = 6.73

Sink 2.96 - 598.99 x (1.74 x 38.33)/90.78 = 665.68/90.78 = 7.33

Sink 2.78 - 665.68 x (4.60 x 51.92)/95.38 = 904.51/95.38 = 9.48

Float 2.78 - = 70.01

Float 2.96 - (4.62 x 70.01) + (4.60 x 51.92)/9.22 = 562.28/9.22 = 60.99

Float 3.09 - 562.28 + (1.74 x 38.33)/10.96 = 628.97/10.96 = 57.39

Float 3.30 - 628.97 + (2.53 x 27.49)/13.49 = 698.52/13.49 = 51.78

In order to prove the validity of Table 10, all cumulative floats and sinks should equal the total head sample. These calculations are shown as follows:

Size Fraction (µm)	Specific Gravity	Calculations from Table 10	Head from Table 9 %
+12,400 x 149	2.78	(9.48 x 95.38) + (70.01 x 4.62)/100 = 12.28	12.28
	2.96	(7.33 x 90.78) + (60.99 x 9.22)/100 = 12.28	12.28
Total Sample	3.09	(6.73 x 89.04) + (57.39 x 10.96)/100 = 12.28	12.28
	3.30	(6.12 x 86.51) + (51.78 x 13.49)/100 = 12.28	12.28

Appendix C

CHEMICAL LABORATORY

GENERAL DESCRIPTION: SIDERITE AOD
FROM: W. CAMERON
LOCATION: M.S.L.
PROJECT: 3.4.9.9.99

TYPE OF ANALYSIS: CHEMICAL
SECTION: ORES & FIRE ASSAY

REPORT NO: 55[illegible]
RECEIVED: 25 MAR. 1985
COMPLETED: [illegible]
NO. OF DETN'S: [illegible] 32

LAB. NO.	SAMPLE DESCRIPTION	SIO2		FA	FE	S	SI	CA	MG	AL	MN	Ex Base
85-0572	FLOT. +1/2" - SP. GR. 3.3	5774		.052	9.769	.183	56.415	2.288	1.862	18.353	.389	-70.62
85-0573	SINK +1/2" - SP. GR. 3.3	6.32		.023	35.546	2.803	5.876	2.169	5.793	1.124	2.184	+0.96
85-0574	FLOT. +1/2" - SP. GR. 3.09	55 36		.052	11 126	.183	52.098	2.076	2.881	18.472	.331	-65.63
85-0575	SINK +1/2" - SP. GR. 3.09	28 90		.045	20.162	.519	25.082	7.187	4.471	8.435	1.265	-21.86
85-0576	FLOT. +1/2" - SP. GR. 2.96	65.84		.067	6.549	.135	64.827	1.726	1.740	22.019	.15	-83.38
85-0577	SINK +1/2" - SP. GR. 2.96	43.38		.042	14.241	.764	45.451	6.033	3.127	12.552	.672	-48.84
85-0578	FLOT. +1/2" - SP. GR. 2.78	66.06		.077	3.425	.052	71.176	3.352	1.951	19.936	.120	-85.31
85-0579	SINK +1/2" - SP. GR. 2.78	52.46		.063	7.925	.249	53.5	5.105	3.519	19.057	.289	-63.93
85-0580	FLOT. -1/2+28M - SP. GR. 3.3	53.16	(1)	.056	9.992	.487	54.671	4.476	2.722	15.212	.469	-62.68
85-0581	SINK -1/2+28M - SP. GR. 3.3	5.96	(1)	.028	35.624	1.78	4.758	2.74	6.539	.959	2.423	+3.56
85-0582	FLOT. -1/2+28M - SP. GR. 3.09	59.90	(1)	.065	6.896	.154	61.263	3.709	2.297	18.946	.243	-74.22
85-0583	SINK -1/2+28M - SP. GR. 3.09	27.28	(1)	.069	21.96	.77	22.038	7.459	5.231	5.756	1.239	-14.7
85-0584	FLOT. -1/2+28M - SP. GR. 2.96	61.11	(1)	.069	5.153	.087	65.127	4.127	2.161	19.518	.183	-78.36
85-0585	SINK -1/2+28M - SP. GR. 2.96	33.02	(1)	.051	14.468	.545	36.124	6.736	4.33	16.252	.586	-41.31
85-0586	FLOT. -1/2+28M - SP. GR. 2.78	73.54	(1)	.08	3.198	.059	80.486	3.610	1.216	16.29	.147	-91.75
85-0587	SINK -1/2+28M - SP. GR. 2.78	51.36	(1)	.06	7.789	.09	52.564	5.704	3.572	19.089	.278	-62.38

ANALYST: W.S R.K.C.

CHEMICAL LABORATORY

GENERAL DESCRIPTION:
FROM: W. CAMERON
LOCATION:
PROJECT:

TYPE OF ANALYSIS:
SECTION:

REPORT NO: 85-03-1
RECEIVED:
COMPLETED:
NO. OF DETN'S:

LAB. NO.	SAMPLE DESCRIPTION	SIO2	%	FE	FE	S	Si	CA	MG	AL	MN	EX BASE
85-0588	FLOT. -28+100M - SP. GR. 3.3 ✓	50.08		.052	10.234	.259	43.504	7.998	4.182	10.675	.597	-40.0
85-0589	SINK -28+100M - SP. GR. 3.3 ✓	4.72		.026	35.86	3.016	4.361	2.486	5.751	.965	2.169	+2.91
85-0590	FLOT. -28+100M - SP. GR. 3.09 ✓	58.98		.062	6.86	.141	53.934	9.29	3.563	12.4	.363	-53.48
85-0591	SINK -28-100M - SP. GR. 3.09 ✓	15.28		.032	24.301	.821	11.177	11.885	6.487	3.507	1.428	+3.69
85-0592	FLOT. -28-100M - SP. GR. 2.96 ✓	71.38		.076	3.854	.09	72.614	5.923	1.999	15.12	.169	-79.81
85-0593	SINK -28+100M - SP. GR. 2.96 ✓	21.22		.039	15.246	.237	19.28	16.180	7.304	8.43	.801	-4.22
85-0594	FLOT. -28+100M - SP. GR. 2.78 ✓	84.38		.088	1.583	.075	92.52	5.796	.603	10.415	.107	-96.54
85-0595	SINK -28+100M - SP. GR. 2.78 ✓	48.22		.058	7.290	.097	44.542	5.725	3.499	19.682	.256	-54.97
591	-28+100M on bag.											
592	-28+100M " "											

ANALYST: R.R.C.